Predictive and Personalized Medicine with Systems Biology Solutions

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Abstract

Systems biology refers to the use of systems engineering and systems science techniques to the understanding of biological systems. At Indiana Center for Systems Biology and Personalized Medicine (ICSBPM), we are particularly interested in developing systems biology techniques that can help shorten the gaps between basic biomedical research and clinical applications of genome sciences toward predictive and personalized medicine. In the past several years, ICSBPM has developed many critical informatics resources for the systems biology and personalized medicine community.

The database and software tools that we developed have promoted systems biology and personalized medicine research communities at the national scale. These tools include: **HPD**, an integrated human pathway database and analysis tool (Chowbina et al., in *BMC Bioinformatics* 2009, 10(S11): S5); **HAPPI**, a human annotated and predicted protein interaction database (Chen et al., in *BMC Genomics* 2009, 10(S1):S16); **HIP2**, a Database of Healthy Human Individual's Integrated Plasma Proteome (Saha et al., in *BMC Medical Genomics* 2008, 1(1):12); **PEPPI**, a Peptidomic Database of Protein Isoforms (Zhou et al., in *BMC bioinformatics* 2010, 11(S6), S7); **ProteoLens**, a multi-scale network visualization and data mining tool (Huan et al., in *BMC bioinformatics* 2008, 9(S9):S5); **GeneTerrain**, a visual exploration tool for network-organized expression panel biomarker development (You et al., in *Information Visualization* 2010, 9(1)), and **C-Maps**, comprehensive molecular connectivity maps between disease-specific proteins and drugs (Li et al., in *PLoS Computational Biology*, 5(7), e1000450).

These tools has been demonstrated to help improve tumor classifications, understand cancer biological systems at the systems scale, tackle biomarker discovery challenges, and facilitate clinical adoption of predictive models developed from computational techniques. We hope that our experience and resources can cement collaborative translational medicine research towards predictive and personalized medicine applications.